

NYMPHS, NAIADS, AND LARVÆ.

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"*Yon nymphs, called naiads, of the wand'ring brooks.*"
—*Shakespeare.*

The object of this note is to propose an addition to the terminology of the metamorphoses of insects, which I believe will tend to make more clear certain fundamental distinctions now generally recognized.

The older entomologists recognized two types of postembryonic development of insects. These types were distinguished by various terms, but were most commonly described as *incomplete metamorphosis* and *complete metamorphosis*. The term *larva* was applied by these writers to the early stages of all insects, those undergoing an incomplete metamorphosis as well as those in which the metamorphosis is complete.

At a later period, during the last quarter of the last century, it was found desirable to distinguish the early stages of insects with a complete metamorphosis from those of insects with an incomplete metamorphosis; hence the term *larva* was restricted to the young of insects with a complete metamorphosis and the term *nymph*, which had been formerly used as a synonym of pupa, was applied to the young of insects with an incomplete metamorphosis.

In the earlier descriptions of these two types of metamorphosis account was taken only of the difference in degree of the change in the form of the body that distinguishes the two types; in one the change is partial or incomplete, in the other it is complete. The fundamental reason for this difference was not generally appreciated although it was understood by some writers.

Fritz Muller in his "Für Darwin" (1864) points out clearly the essential difference between incomplete metamorphosis and complete metamorphosis and in discussing the latter makes the aphorism, "There were, I believe, perfect insects before larvæ and pupæ." The significance of this aphorism should be clearly understood by every student of entomology, which is far from being the case. This is shown by the fact that frequently writers refer to larval characteristics as being more generalized than the corresponding characteristics of the adult.

The fundamental fact that should be understood is that larvæ, *i. e.*, the young of insects with a complete metamorphosis, exhibit a cenogenetic or sidewise development. Here the form of the body bears but little relation to the form to be assumed by the adult, the nature of the larval life being the controlling factor. While the ontogeny of an orthopterous insect can be taken as an indication of the course of the phylogeny of the race to which it belongs, this obviously is not the case with representatives of the Diptera or the Lepidoptera. In these orders, and in others with a complete metamorphosis, the larvæ have been sidewise developed while the adults have continued their specialization in a direct line. This is an illustration of the fact pointed out by Darwin in his "Origin of Species," that at whatever age a variation first appeared in the parent it tends to reappear at a corresponding age in the offspring.

The more striking of the adaptive characteristics of larvæ are: the form of the body; the internal development of wings; and the retarding of the development of the compound eyes. It is obvious that the restriction of the application of the term larva to the designating of this type of immature insect is a useful one.

Let us now study those immature insects to which the term nymph has been applied, those that were formerly classed as having an incomplete metamorphosis.

It is now quite generally recognized that this group of insects included those exhibiting two quite distinct types of metamorphosis: first, those, as the Orthoptera and Hemiptera for example, in which the development is direct; and second, those in which there is a cenogenetic development. The second group includes the Plecoptera, the Odonata, and the Ephemera.

In this second group the ontogeny of the individual does not represent the phylogeny of its race. The recognition of this fact has led to the introduction of a term indicating a third type of metamorphosis. We have, therefore, in the more recent textbooks the following categories, in addition to development without metamorphosis, which is characteristic of the Thysanura and Collembola.

First, *gradual metamorphosis* or paurometabolous development. This is characteristic of the Orthoptera, Hemiptera, *et al.*

Second, *incomplete metamorphosis* or hemimetabolous development. This is characteristic of the Plecoptera, Odonata, and Ephemera.

Third, *complete metamorphosis* or homometabolous development. This is characteristic of the Diptera, Lepidoptera, *et al.*

The features of the cenogenetic development of insects with an incomplete metamorphosis, as the term is now restricted, are very different from those of the cenogenetic development of insects with a complete metamorphosis. In insects with an incomplete metamorphosis the immature stages are modified so as to fit them for aquatic life; the more striking features of larvæ, the elongate form of the body, the internal development of wings, and the retarding of the development of the compound eyes are not exhibited by them.

From this it can be seen that the immature stages of the Plecoptera, the Odonata, and the Ephemera differ fundamentally from those of insects with a gradual metamorphosis on the one hand and from those of insects with a complete metamorphosis on the other; and that the reasons that make desirable the restriction of the use of the term larva to designate the young of insects with a complete metamorphosis make desirable a distinctive term for the sidewise developed young of those with an incomplete metamorphosis.

I, therefore, propose the restriction of the term *nymph* to the designating of the early stages of insects with a gradual metamorphosis and the use of the term *naiad* for designating the immature stages of the Plecoptera, Odonata, and Ephemera.

If this proposal is adopted the three terms, nymph, naiad, and larva will each indicate a distinct type of immature insect; and their use will tend to emphasize the distinctive characteristics of the three types of metamorphosis.